PORTABLE SOLAR HOME SYSTEM TESTING REPORT

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SUBMITTED TO: THE PEOPLES' PORTABLE POWER (PPP) CO. LTD

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TABLE OF CONTENTS

PREFACE

The solar home system supplied by Peoples Portable Power (PPP) Company is a portable solar PV system with physical size of (243.5 x 230 x 66) mm and 11.95kg net weight. The system has a rated capacity of 90,000mAh (324 Wh) and 15 – 20 V, 3 A input. The output of the system is rated at; 12 VDC 3 A and 24 VDC 3A. It also includes USB Output of four 5 VDC, 2.1 A. Also it's charging time is rated to about 8hours.

This system is intended to supply power for daily usage, such as: lights, cell phone charging, laptop computer, TV, fan and other low power electrical equipment (75 W max). Each unit come with USB cable for cell phone charging, system charger, 3 x 3 W LED lumps, a torch which includes radio and 20 Wp solar panel.

The Arusha Technical College Solar Training Centre (ATC-STC) was consulted by Peoples Portable Power to do the safety, durability and system performance testing and customer satisfaction analysis for truth in advertising to protect consumers. This is the preliminary task to be followed by the quality verification process be VeraSol as a requirement of the Lighting Global Quality Standards (or quality standards in IEC 62257-9-8).This work has been completed successfully within agreed time frame.

Generally, the customer analysis and the tests performed reveals that, the system requires some technical improvement and after sell customer training.

1.2. CUSTOMER INTERVIEW FEEDBACK

The interviews with customers revealed that, the supplied units with 20 W panel had some issues. The two, 3w lamps units do not supply power for more than 3 hours during the night. This is due to the fact that, the 20 Wp panel can only charge the system for maximum of 30% of the rated capacity per day, therefore, the energy stored is always insufficient, unless they charge the unit using utility supply.

Some of the customers explained that, they opt to charge their system with utility supply due to insufficient charge from the solar panel. Once fully charged, they normally use the system for lighting for more than a week. This signifies that, once fully charged, the system is sufficient to power the 3 lamps for more than one week before re-charging it again. Unfortunately, this is only possible for the areas which are nearby the national grid. For the use in off-grid area the system needs to be fully charged by the solar panel.

Some of the customers interviewed, were supplied either with 3 panels of 20 Wp each or a single 60 Wp panel. This group is satisfied with this package, since their lights can remain on for the whole night.

Some customers are using up to 11 lamps of 3 W with 5 panels of 20 W each. This makes 100 Wp PV array which is technically sufficient to charge the 90Ah system battery.

The feedback obtained from the interviewed customers are as summarized in the following table.

1.3. SYSTEM USAGE

The system is very user friendly and relatively light in weight. The 12 VDC and the four (4) USB ports are very useful for multiple use of the system simultaneously. The 24 VDC outlet is not used as it was designed for a special adaptor (not supplied with the unit) powering a laptop. This outlet could be very useful if the manufacturer provided standard outlet used for all laptops.

2. PHYSICAL OBSERVATION

The ON/OFF switch has a very delicate covering which easily worn out after being used for a relatively short time, for example one year. Figure 1 shows the worn out power switch cover from one of the units.

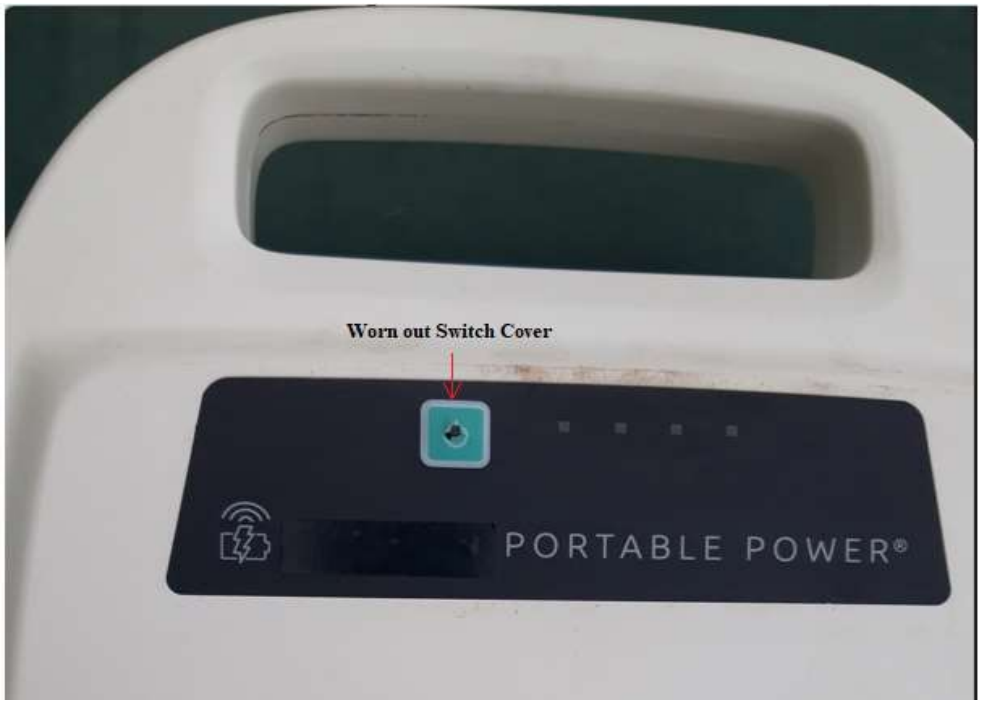

Figure 1

3. TESTING RESULTS

This system testing part is done at Arusha Technical College Solar Training Centre (ATC-STC). The major aim for this part is to test and justify the technical performance of the system. This can help in making some technical improvements so as to come up with highly performing system which can satisfy customer needs for both off-grid and grid connected locations. The tests done were based on: system charging, usage capacity, physical strength and sustainability.

3.1. SYSTEM CHARGING

The system has two charging options, such as; solar panels and utility power. The option of using charging adaptor is applicable where utility grid is available; otherwise, for off-grid areas solar panels are used. However, the system is supplied with 20 Wp solar panel regardless of the location. The system charging was tested using solar panels with different ratings, such as 20 Wp and 60 Wp so as to establish best charging option for off-grid areas.

3.2. SYSTEM CHARGED BY 20 Wp PANEL

The system is tested with the same 20 Wp panel while the state of charge was between (0 – 24%), i.e., the first indicator light flashing. The connection was as shown in Figure 2.

Figure 2

RESULTS

i) The system was charged from 9:00am to 06pm.

Observation: Only the first indicator still blinking

ii) The system was re-charged on the second day from 9:00am to 06pm.

Observation: First indicator light is ON and the second is blinking

iii) The system was again re-charged on the third day from 9:00am to 06pm.

Observation: First and second indicator lights were ON and the third is blinking

iv) The system was again re-charged on the fourth day from 9:00am to 06pm.

Observation: First, second and third indicator lights were ON and the fourth is blinking

Insight: The 20 Wp panel can take four days to fully charge the system (no load connected), hence, not suitable for use in off-grid areas.

3.3. SYSTEM CHARGED BY 60 Wp PANEL

The system with state of charge between (0 – 24% ie. the first indicator light flashing) was charged with 60 Wp panel. The connection was as shown in Figure 3.

Figure 3

RESULTS

i) The system was charged from 9:00am to 06pm.

Observation: Two indicator lights were **on** and the third light was flashing.

Insight: The 60 Wp can charge the system to at least 50 - 74% per day

ii) The system was again charged for five hours (9:00am to 02pm) on the second day without discharging the previous day charged status.

Observation: All the indicator lights were **on**

Insight: The system reached 100% state of charge for at least one and half days

iii) Another system was charged from 9:00am to 06pm and 2 lamps of 3 W each were connected to it for 12 hours (night).

Observation: in the morning, it was found that the lamps were still **on,** but only the first indicator lamp was flashing

Insight: The stored charge is not sufficient for loads above 6 watts (only 2 x 3 W lamps)

3.4. THE SYSTEM STORAGE CAPACITY

The systems battery storage capacity was tested (the system was not a brand new).

Observation: The energy storage capacity obtained was 294.19 Wh as in Figure 4. This result is 90.8% of the rated system capacity (324Wh, from the user manual).

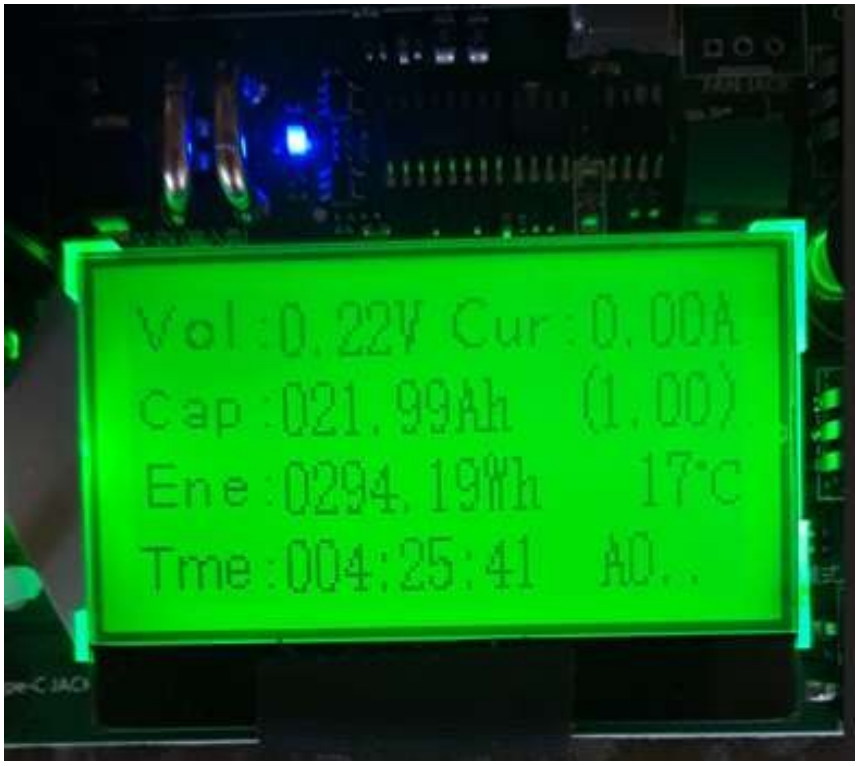

Figure 4

Insight: Since the tested battery is not brand new, the rated capacity of 324 Wh for the new battery might be correct.

4. CONCLUSION

The 60 Wp panel can therefore be used if the customer consumption do not exceed 50 – 60% of the system capacity, otherwise the system stored charge per one day would not be sufficient, since the battery does not reach 100% state of charge in one day.

The customers' needs more reliable system and sufficient for their needs. The areas which are far from utility grid needs 100 Wp panel (5 of 20 Wp) to ensure that the system is fully charged in one day.

For the areas with utility grid (most urban areas) the system can be sold even without solar panels (can only use utility grid supply to charge the system). This option can increase market opportunity, due to reduction in cost of the system without solar panels.

The system needs to be provided with more options of power outlets so that the customers can easily increase number of loads. Generally, the system needs some mechanical and technical improvement as stated in the recommendation part.

5. RECOMMENDATIONS

After interview with customers and some tests conducted, we recommend the following for improvement;

i) The power switch cover should be improved so as to be mechanically strong and attractive.
ii) 3 folded panels of 20 Wp per unit for the near grid users and 5 such panels for the off-grid area users to increase system reliability.
iii) The company should have customer care unit, technical advisors and after sales service.
iv) The manufacturer has to modify the 24VDC outlet so that it can be used for standard laptop adaptors.
v) The system software uploads should be possible without opening the system (uploading port be included), since it is risky and tiresome to unscrew and screw the system frequently for the purpose of updating the system firmware. Wireless option would be the best solution.
vi) Where the grid supply is available, the system can be used as a backup, charged with grid, therefore, solar panels are not necessary for such areas.
vii) The customers supplied with 20 Wp solar panels has to be given 2 to 4 more panels, depending on the area they are. This would increase trust, market, reliability and customer satisfaction

APPENDIX

QUESTIONS FOR CUSTOMER SATISFACTION ANALYSIS

PRODUCT: PORTABLE POWER SYSTEM

CLIENT: PEOPLES PORTABLE POWER

CONSULTANT: ARUSHA TECHNICAL COLLEGE

DATE: ……

CUSTOMER DETAILS

NAME	
PHONE No.	
SYTEM ID	
DATE PURCHESED	
DATE SURVEYED	
CURRENT STATUS	

INTERVIEW QUESTIONS

1. How long have you been with the PPP product?

   Response:

2. What are your appliances?

   Response:

3. What size of solar panel is connected to your system?

   Response:

4. How long does your system take before it turns off per day?

   Response:

5. Do you have other source of power, apart from PPP system?

   Response:

6. Does the system satisfies your needs?

   Response:

7. What problem did you experienced regarding the system?

Response:

8. Have you been trained on how to use your system and some precautions to take?

Response:

9. How often does your system fail?

Response:

10. Normally, what do you do in case of your system failure?

Response:

11. Do you get technical assistance from your supplier, once your system fails?

Response:

12. If yes, do they charge you for repair done?

Response:

13. When was the last failure of your system and how did you solve it?

Response:

14. When was your last communication with your system supplier?

Response:

15. What motivated you to have this system when you bought it?

Response:

16. Will you recommend this unit to others?

Response:

17. Did your supplier offered you warrant for the system?

Response:

18. What do you recommend to be included in the unit in future version?

Response: